

2004 RESEARCH RESULTS

Charles Schelz / SEUG Ecologist

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ARCHES NATIONAL PARK 2005 Research Permits

Permit#: ARCH-2004-SCI-0001

Principal Investigator: Mr Joel Berwick, U. S. Department of Energy, 2597 B3/4 Road,
Grand Junction, CO 81503

Additional investigator(s):

Name: Michael J. Gardner Phone: 970-248-6031 Email: mike.gardner@gjo.doe.gov

Project Title:

**THE MOAB SITE ENVIRONMENTAL AIR MONITORING PROGRAM - CONDUCTED BY THE
U.S. DEPARTMENT OF ENERGY'S OFFICE OF ENVIRONMENTAL MANAGEMENT LOCATED
IN GRAND JUNCTION, COLORADO.**

Objectives:

The U.S. Department of Energy (DOE) took custody of the former Atlas uranium mill site in Moab, UT on October 25, 2001. As part of DOE's overall environmental monitoring strategy, a network of particulate air samplers has been installed at the former mill site and at various locations throughout the surrounding community for the purposes of determining compliance with various DOE Orders, and any applicable Federal and State air quality regulations. DOE is specifically monitoring for certain radioisotopes that are common constituents of uranium mill tailings. Namely, the radioisotopes that are currently monitored at the Moab site include Po-210, Ra-226, Th-230, and natural (total) Uranium. In addition to collecting radioparticulate samples at the entrance to Arches National Park, DOE also monitors concentrations of radon-222 gas, and direct gamma radiation. Data collected from the radioparticulate, radon-222, and direct gamma radiation samples are then compared to background (naturally occurring) levels to determine what impacts (from the nearby mill tailings pile), if any, are observed within the boundaries of Arches National Park.

Findings and Status:

Monitoring data collected during 2004 indicate that concentrations of airborne radioparticulates (i.e., Po-210, Ra-226, Th-230, and natural [total] Uranium), atmospheric radon-222, and direct gamma radiation levels observed at the Arches National Park monitoring location are indistinguishable from background (naturally occurring) concentrations and levels. None of the 2004 data collected at this location exceeded any regulatory limit, threshold, or guideline that is applicable to this study. The uranium mill tailings stockpiled at the former Atlas mill site (located approximately 0.75 miles south of the Arches National Park entrance) do not appear to have any significant impact upon air quality and public radiation dose/exposure levels, as measured at the entrance to Arches National Park. DOE is required to conduct environmental monitoring and surveillance at sites where DOE activities have the potential to release

contaminants to either the public and/or the environment. DOE will continue to monitor air quality and public exposure limits at this location to document negative exposure and public impacts, and to better understand variations in seasonal air quality conditions.

Permit#: ARCH-2004-SCI-0005

Principal Investigator: Dr Jayne Belnap, Canyonlands USGS, 2290 SW Resource Blvd.,
Moab, UT 84532

Additional investigator(s):

Name: David Chandler Phone: 435-797-7326 Email: dchandle@mendel.usu.edu

Project Title:

**CARBON AND NITROGEN CYCLES IN ARID LANDS: THE ROLE OF BIOLOGICAL SOIL
CRUSTS AS INFLUENCED BY SOIL SURFACE DISTURBANCE, CLIMATE CHANGE AND
ANNUAL GRASS INVASION**

Objectives:

This project will establish how alterations in species composition by surface disturbance, invasive grasses, and/or climate change may affect N and C inputs and fluxes, in different soils under different climatic regimes.

Findings and Status:

This study is ongoing and the data collected in 2004 has not been analyzed yet.

Permit#: ARCH-2004-SCI-0006

Principal Investigator: Mr Michael J. Wilson, USDA Forest Service, Interior West Forest
Inventory, Rocky Mtn. Research Station, 507 25th Street, Ogden, UT
84401

Additional investigator(s):

Name: Roger Boyer Phone: 801-625-5541 Email: rboyer@fs.fed.us

Project Title:

ANNUAL FOREST LAND INVENTORY OF UTAH

Objectives:

Gather information on the quantity and quality of forest resources, growth, mortality, removals, and forest health.

Findings and Status:

State..... Utah

County..... Grand

Location Number..... 299

Date of Inventory..... 9/10/2004

Current Location Status..... At least one accessible forest land condition class present on one or more of the subplots

Elevation..... 4958

Condition Class Number..... 1
Condition Class Status..... Accessible forest land (includes nonstocked forest - e.g. burned area or clearcut)
Forest Type..... Juniper woodland
Stand-size Class..... 9.0 - 19.9 in (softwoods)/11.0 - 19.9 in(hardwoods)
Physiographic Class..... Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most steep slopes with a southern or western exposure.
Condition Habitat Type..... Juos Series

The Annual Forest Land Inventory of Utah project is an ongoing natural resource inventory. Results of the inventory are periodically updated and made available at www.fs.fed.us/rm/ogden.

Permit#: ARCH-2004-SCI-0009

Principal Investigator: Dr John Peacock, 185 Benzler Lust Road, Marion, OH 43302-8369

Project Title:

A STUDY OF THE DISTRIBUTION OF CATOCALA BENJAMINI AND RELATED CATOCALA IN NORTHEASTERN ARIZONA AND SOUTHEASTERN UTAH.

Objectives:

The purpose of this study is to delineate the distribution of *Catocala benjamini* and related *Catocala* in northeastern Arizona and southeastern Utah, areas that are poorly, if at all, collected, and where little is known of *Catocala* distribution. A secondary objective is to determine the larval host plant (*Quercus*) associations where *Catocala* are collected.

Findings and Status:

Two bait traps were deployed adjacent to a pull-out near Courthouse Rock in the late afternoon of 7 June 2004. *Catocala* (Noctuidae) collected in the traps overnight were determined early on 8 June. Two species were recorded: *Catocala benjamini* and *C. verrilliana*. Two specimens of *benjamini* and one of *verrilliana* were collected and are presently housed in the collection of John W. Peacock. Further study is still needed in the area to determine the distribution of *C. benjamini*.

Permit#: ARCH-2004-SCI-0010

Principal Investigator: Dr Jonny Hesthammer, Department of Earth Sciences, University of Bergen, Allten 41, 5007 Bergen, Norway

Additional investigator(s):

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Project Title:

OVERLAPPING FAULTS IN POROUS SANDSTONE

Objectives:

The purpose of the study is to understand how deformation structures in porous sandstones affect fluid flow.

More specifically, we are interested in investigating how laterally overlapping extensional faults affect fluid flow across otherwise sealing fault zones in petroleum reservoirs. In order to do this, we conduct outcrop analogue studies. In Arches NP, in the Cache Valley, two overlapping extensional faults bound an overlap zone (relay ramp) on the trail to the Delicate Arch (the trail moves up the slickrock ramp about 1 km from the parking lot - everyone who goes to Delicate Arch actually cross this relay ramp). In order to understand how fluids would flow through the porous sandstones in the relay ramp, we mapped in detail small-scale deformation structures. These structures are deformation features that formed associated with the faulting in the Cache Valley, and are referred to as deformation bands.

Findings and Status:

The study reveals an intensely deformed ramp with frequent, potentially flow-hindering, cataclastic (involves grain crushing) deformation bands. The deformation bands display a wide range of orientations across the ramp and causes extensive compartmentalization at a variety of scales. The study demonstrates that caution must be exercised when considering relay ramps as fluid conduits across sealing faults in a reservoir setting. Although relay zones may maintain large scale geometric communication, an array of potentially flow-hindering structures may be present within the ramp. This is contrary to the commonly accepted notion that relay ramps represent efficient conduits for fluid flow across sealing fault zones in petroleum reservoirs.

Permit#: ARCH-2004-SCI-0011

Principal Investigator: Ms Alicyn Gitlin, 2135 S. Ash Lane, Flagstaff, AZ 86004

Project Title:

FACTORS INFLUENCING DISTRIBUTION & MORTALITY OF A DOMINANT RIPARIAN TREE

Objectives:

This project is investigating drought-related mortality in cottonwood trees (*Populus* sp.). As a result of research conducted in 2003, tamarisk presence was identified as the most important factor related to Fremont cottonwood (*P. fremontii*) drought mortality.

Research in 2004 focused on the effect of tamarisk removal on cottonwood tree growth and soil fertility. Sites where tamarisk had been removed were paired with comparable sites of tamarisk presence. At each site, annual branch growth increments (an indication of water available to the tree) were measured, and soils were collected for lab analysis of salinity, N & C content.

Findings and Status:

The effect of tamarisk removal varies by site. There was not a consistent increase in cottonwood growth when tamarisk was eradicated. However, two trends emerged from this study and warrant further investigation. First, most restored sites had improved growth in 2003, a year which followed several years of extreme drought. Second, there is evidence that tamarisk presence may cause cottonwood trees to shift from a strict reliance on groundwater to a dependence on surface soil moisture. Branch growth in many sites with tamarisk presence correlated with local precipitation &/or streamflow totals, but none of the restored sites showed a relationship between surface water availability and tree growth. This indicates that tamarisk removal is enabling cottonwood roots to access groundwater, and may lead to better drought resilience in restored stands.

Both research sites in Arches National Park, Courthouse Wash and Lost Spring Canyon, showed improved tree growth in restored stands for all post-removal years. Branch growth in the non-restored section of Courthouse Wash was positively correlated with annual January through September precipitation totals; the restored segment did not exhibit this relationship. Lost Spring Canyon had only a single growth season since removal, so it was not possible to attempt any correlation.

Soil data is still pending.

Permit#: ARCH-2004-SCI-0013

Principal Investigator: Dr Randall Marrett, Department of Geological Sciences, University of Texas at Austin, 1 University Station C1100, Austin, TX 78712-0254

Additional investigator(s):

Name: Timothy D. Gibbons Phone: 314-807-4541 Email: tgibbons@mail.utexas.edu

Project Title:

SPATIAL ARRANGEMENT OF DEFORMATION BANDS IN THE MOAB MEMBER OF THE ENTRADA SANDSTONE

Objectives:

The goal of the project is to quantify the arrangement in space of deformation bands, which are a special type of fault that forms in sandstones having high porosity at the time of deformation. Deformation bands are common in the Entrada Formation throughout Arches National Park, typically showing a braided pattern of mm- to cm-scale ridges protruding above the level of slickrock exposures.

Faults, such as deformation bands, are one category of fracture. The spatial arrangement of fractures in rock is poorly understood: in some cases fractures apparently are randomly located, but in other cases they are clustered in space whereas in still other cases they are regularly spaced. Spatial organization of a fracture array emerges spontaneously through interaction of individual fractures during growth, sometimes producing a natural fractal. We recently have developed new techniques for quantifying spatial organization of fractures, and will apply these techniques to the deformation bands of Arches National Park.

Field work in the park will focus on collecting data for spatial analysis of deformation bands. Field work will consist of measuring the distance from one deformation band to the next along a line of observation following nearly continuous outcrop of the Moab Member of the Entrada Formation. Measurements will be done using a combination of tape measure, compass, and GPS. No samples will be collected within the park, nor will there be any permanent evidence of our having passed through.

Findings and Status:

Data collection took place using a line of observation where orientation and spacing were noted for every individual structural feature encountered. In all, 1702 fractures were surveyed along the line of observation that was 9.5 km long. 1467 of the fracture were deformation bands.

Analysis of the data is on-going. Preliminary analysis shows that deformation bands are clustered in a non-random manner. This suggests interaction among faults during deformation.

Permit#: ARCH-2004-SCI-0013

Principal Investigator: Mr Michael Firnhaber, Post Box 2046, Estes Park, CO 80517

Project Title:

RECORDING BARRIER CANYON STYLE ROCK ART.

Objectives:

The purpose of the proposed study is to record, for the purpose of analysis and interpretation, the Barrier Canyon Style rock art tradition.

Findings and Status:

Due to funding shortfalls, no activity took place during this calendar year. The project is scheduled to take place during the first half of 2005.

Permit#: ARCH-2004-SCI-0014

Principal Investigator: Dr Gery Allan, Northern Arizona University, Biological Sciences Dept.
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Additional investigator(s):

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Name: Thomas Whitham	Phone: 928-523-7515	Email: thomas.whitham@nau.edu

Project Title:

USING BIOTECHNOLOGY TO RESTORE RIPARIAN HABITATS IN THE WEST: GENETIC AND GENOMIC STUDIES OF BIODIVERSITY AND DROUGHT TOLERANCE

Objectives:

This study examines the link between the genetic diversity of a dominant riparian tree and biodiversity in riparian ecosystems.

Findings and Status:

To examine the link between genetic diversity and biodiversity in a dominant riparian tree, we initiated genetic analyses of cottonwood trees in Arches National Park. We sampled leaves for DNA analysis from two sites: Courthouse Wash and Lost Springs. In Courthouse Wash we sampled 28 trees. In Lost Springs we sampled leaves from 10 trees for a total of 38 trees from Arches NP. We have extracted DNA from all 38 trees. DNA from these trees is being processed for genetic analysis. This analysis includes the generation of molecular markers called AFLPs (Amplified Fragment Length Polymorphisms). These markers will allow us to genetically fingerprint individual trees and compare their genetic profile with the genetic profile of other cottonwood trees found in other national parks. Our preliminary analyses indicate that cottonwood trees in Arches NP are genetically unique, representing distinct genotypes. Additional analyses are underway and should be completed by Fall 2005.

Permit#: ARCH-2004-SCI-0016

Principal Investigator: Mr James Von Loh, e2M, 9563 South Kingston Court, Suite 200,
Englewood, CO 80112

Project Title:

**VEGETATION DATA COLLECTION IN SUPPORT OF THE U.S. GEOLOGICAL SURVEY -
NATIONAL PARK SERVICE VEGETATION CLASSIFICATION AND MAPPING PROGRAM
AT ARCHES NATIONAL PARK**

Objectives:

The National Park Service (NPS) and U.S. Geological Survey (USGS) are cooperating to produce detailed vegetation classifications and digital databases, including vegetation maps, as part of the National Biological Information Infrastructure Program (NBII).

Findings and Status:

While no field data collection was performed in ARCH in 2004, several other vegetation classification and mapping tasks were conducted. Local descriptions were written to describe the 62 tentatively recognized vegetation associations. A provisional field key was developed to be used during the accuracy assessment in 2005. A draft final report template was prepared and populated with available information. Photointerpretation is currently being conducted and in 2005 points will be selected and visited.

Permit#: ARCH-2004-SCI-0017

Principal Investigator: Mr David Sucec, BCS Project, 832 Sego Avenue, Salt Lake City, UT
84102

Additional investigator(s):

Name: Craig Law Phone: 435-752-2327 Email: claw@wpo.hass.usu.edu

Project Title:

BCS PROJECT / BARRIER CANYON STYLE ROCK ART DOCUMENTATION.

Objectives:

The objectives of the BCS PROJECT documentation project are to record all Barrier Canyon style rock art images with archival photographic prints (gelatin-silver and ultra-stable color prints), to create a complete inventory of the documented sites, and to generate a scholarly description and analysis of the imagery.

Findings and Status:

No activity was conducted this report year.

